

# **R&D Topics for Neutrino Factory Acceleration**

J. Scott Berg  
Brookhaven National Laboratory  
NuFact07  
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# Outline

- Initial linac
- Recirculating linear accelerators (RLAs)
- Fixed field alternating gradient accelerators (FFAGs)
- General issues

# Initial Linac

- Tracking through to end
- Expect problems with large transverse amplitude

# RLAs

## Design Completion



- Bring a design to detailed completion
- Complete chromatic correction
- Physical layout
  - Switchyard
  - Arc crossings
- Full 6-D tracking

# RLAs

## Engineering and Costing



- Motivation for FFAGs is cost
- Need realistic idea of RLA cost
- Detailed engineering
  - Switchyard and arc crossings
  - Basic magnet technology decisions

# RLAs Optimization

- Can we do better on RLAs?
- More passes
  - Detailed work on switchyard layout
  - Multiple arcs as well
- Choice of energy range (larger/smaller)
- To what extent can we automate?

# FFAGs

- Handling of longitudinal/transverse coupling
  - Dependence of time on transverse amplitude
  - Synchro-betatron coupling in RF cavities
  - Synergy with EMMA studies
- Injection/extraction
- Alternative schemes
  - Scaling FFAG with harmonic number jump
  - Constant-tune nonlinear non-scaling

# General Issues

- System optimization
  - In particular, linac to RLA transition point
  - Overall dependence on transverse emittance
- Transfers between stages
  - Matching, particularly longitudinal
  - Tracking for losses
  - Input into cost



# General Issues

## RF Issues



- R&D on high gradient RF
  - Important for linac, FFAGs
  - Operating with 0.1 T field on cavities
- Beam loading issues
  - Loading down bunch train, correction
  - Loading between trains: how to have same energy gain?
    - ✧ Especially for FFAGs